



Data User Guide

RSS Monthly 1-deg Microwave Total Precipitable Water netCDF V7R01

Introduction

The Remote Sensing Systems (RSS) Monthly 1-degree Microwave Total Precipitable Water (TPW) netCDF dataset V7R01 provides global total columnar water vapor values, or TPW, over ocean areas. This dataset contains monthly, 1-degree TPW means, a 12-month climatology made using 1988 to 2007 data, monthly anomaly maps, a trend map with associated global and tropical TPW time series and trends, and a time-latitude plot. The 1 degree TPW dataset is a merged ocean product constructed using version 7 (V7) passive microwave geophysical ocean products made publicly available by RSS (www.remss.com). TPW values for this dataset were acquired from the following satellite microwave radiometers: SSM/I F08 through F15, SSMIS F16 and F17, AMSR-E, AMSR-2, and WindSat. The radiometers used to construct this dataset were inter-calibrated at the brightness temperature level, while the V7 ocean products were produced using a consistent processing methodology across sensors.

Note:

The high quality ocean data is made available thanks to funding from the NASA MEaSUREs (Making Earth System Data Records for Use in Research Environments) project. The Global Hydrology Resource Center (GHRC), processes the cumulative TPW files from RSS into monthly files, and provides the cumulative 20 year climatology file and the cumulative trend files.

Citation

Mears, Carl A., Deborah K. Smith, Kyle Hilburn and Lucrezia Ricciardulli. 2016. RSS Monthly 1-deg Microwave Total Precipitable Water netCDF V7R01 [indicate subset used]. Dataset available online from the NASA Global Hydrology Resource Center DAAC, Huntsville, Alabama, U.S.A.
<https://ghrc.nsstc.nasa.gov/pub/tpw/>. doi:
https://dx.doi.org/10.5067/MEASURES/MULTIPLE/WATER_VAPOR/DATA302

Keywords:

Precipitable water, water vapor, precipitation, microwave, climatology, brightness temperature, oceans

Project Mission

NASA MEaSUREs (Making Earth System Data Records for Use in Research Environments) project

Instrument Description

The RSS Monthly 1-degree Microwave Total Precipitable Water (TPW) netCDF V7R01 data product was constructed using data collected from the following instruments: all SSM/I, SSMIS F16 and F17, AMSR-E, AMSR-2 and WindSat. The Special Sensor Microwave/Imager (SSM/I) is a seven channel passive microwave radiometer operating at four frequencies and dual-polarization. The Special Sensor Microwave Imager Sounder (SSMIS) is also a microwave radiometer that includes a sounder. SSM/I and SSMIS are instruments carried onboard the Defense Meteorological Satellite Program (DMSP) series of polar orbiting satellites. Additional information on the SSM/I and the SSMIS instruments can be found at <http://www.ssmi.com/ssmi/>. The Advanced Microwave Scanning Radiometer – Earth Observing System (AMSR-E), one of six sensors aboard the Aqua satellite, is a twelve-channel, six-frequency, total power passive-microwave radiometer. More information on AMSR-E can be found at <http://www.ghcc.msfc.nasa.gov/AMSR/>. The Advanced Microwave Scanning Radiometer 2 (AMSR2) onboard the GCOM-W satellite is a remote sensing instrument measuring weak microwave emission from the surface and the atmosphere of the Earth. AMSR2 provides measurements of the intensity of microwave emission and scattering. More information on AMSR2 can be found at http://suzaku.eorc.jaxa.jp/GCOM_W/w_amsr2/whats_amsr2.html. WindSat is a polarimetric microwave radiometer aboard the Coriolis satellite which measures ocean surface wind vectors. More information on WindSat can be found at [http://weather.msfc.nasa.gov/sport/survey/windSat/WindSat Reference Guide.pdf](http://weather.msfc.nasa.gov/sport/survey/windSat/WindSat%20Reference%20Guide.pdf).

Investigators

Carl Mears
Deborah Smith
Kyle Hilburn
Lucrezia Ricciardulli
Remote Sensing Systems
Santa Rosa, CA

File Naming Convention

This data collection consists of three files containing monthly, cumulative, and a full climatology of TPW. Each file uses the following naming conventions listed below. Please refer to Table 1 for the monthly file and Table 2 for the cumulative and climatology naming convention variable information.

Monthly file: tpw_v07r01_[YYYYMM].ncV.nc

Cumulative: tpw_v07r01_198801_[YYYYMM]_cumulative.ncV.nc

Climatology: tpw_v07r01_1988_[YYYY]_climatology.ncV.nc

Table 1: Monthly file naming convention variables

Variable	Description
tpw	Total precipitable water
v07	Data made from version-7 RSS data
r01	Algorithm revision 01
YYYY	Four-digit year of the file
MM	Two-digit month of the file
ncV	nc3 = netCDF-3 format nc4 = netCDF-4 format
nc	netCDF file format

Table 2: Cumulative and climatology naming convention variables

Variable	Description
tpw	total precipitable water
v07	data made from version-7 RSS data
r01	algorithm revision 01
198801	Starting year and month of the cumulative data
1988	Starting year of the climatology data
YYYY	Last four-digit year in the cumulative file
MM	Last two-digit month in the cumulative file
YYYY	Ending year of the climatology data
ncV	nc3 = netCDF-3 format nc4 = netCDF-4 format
nc	netCDF file format

Data Format Description

Data are stored in netCDF-3 and netCDF-4 file format. Each data file contains the following dataset characteristics outlined in Table 3.

Table 3: Dataset Characteristics

Characteristic	Description
Platforms	AQUA, Coriolis, DMSP 5D-2/F10, DMSP 5D-2/F11, DMSP 5D-2/F13, DMSP 5D-2/F14, DMSP 5D-2/F15, DMSP 5D-2/F8, DMSP 5D-3/F16, DMSP 5D-3/F17, GCOM-W1
Instruments	SSM/I, SSMIS, WindSat, AMSR-E, AMSR-2
Spatial Coverage	N: 60, S: -60, E: 180, W: -180 (Global oceans)
Spatial Resolution	1 degree
Temporal Coverage	Start date: 01-01-1988 Stop date: Ongoing *Note the climatology file extends from 1988-2007
Temporal Resolution	Monthly
Parameter	Atmospheric water vapor
Processing Level	Level 3
Data Format	NetCDF-3, NetCDF-4

Data Parameters

Each of the three data files contains a set of data fields. Please refer to Table 4 to access the monthly data field information, Tables 5 for cumulative, and Table 6 for the climatology.

Please note that TPW values should range from 0 to 75 kgm⁻².

Table 4: Monthly data fields

Field Name	Description	Unit
global_mean_precipitable_water_anomaly	Monthly average near-global mean precipitable water anomaly over ice-free oceans, 60S to 60N	kg m ⁻²
latitude	Latitude	degrees north
latitude_bounds	Latitude bounds	degrees north
longitude	Longitude	degrees east
longitude_bounds	Longitude bounds	degrees east
platform_names	Names of microwave radiometers who data were used in calculating wind speed by month	N/A
precipitable_water	Monthly average precipitable water over ice-free oceans	kg m ⁻²
precipitable_water_anomaly	Monthly average precipitable water anomaly over ice-free oceans	kg m ⁻²
satellites_used	Satellites used per month for calculating the mean TPW Array dimension: # months x 10 satellites, where 1= used, 0=not used	N/A

	Value	Satellite	
	1	SSMI F08	
	2	SSMI F10	
	3	SSMI F11	
	4	SSMI F13	
	6	SSMI F14	
	5	SSMI F15	
	7	SSMI F16	
	8	SSMI F17	
	9	AMSRE on AQUA	
	10	WindSat on Coriolis	
	11	AMS2 on GCOM-W1	
time	Time		days
time_bounds	Time bounds		days
tropical_mean_precipitable_water_anomaly	Monthly average tropical mean precipitable water anomaly over ice-free oceans, 20S to 20N		kg m ⁻²

Table 5: Cumulative data fields

Field Name	Description	Unit
latitude	Latitude	degrees north
latitude_bounds	Latitude bounds	degrees north
longitude	Longitude	degrees east
longitude_bounds	Longitude bounds	degrees east
Linear_trend_in_precipitable_water_anomaly	Linear trend in monthly average precipitable water anomaly over ice-free oceans	kg m ⁻² decade ⁻¹
time	Time	day
time_bounds	Time bounds	day
time_lat_precipitable_water_anomaly	Monthly average precipitable water anomaly over ice-free oceans	kg m ⁻²
tropical_mean_precipitable_water_anomaly	Monthly Average Tropical Mean Precipitable Water Anomaly over Ice-Free Oceans, 20S to 20N	kg m ⁻²

Table 6: Climatology data fields

Field Name	Description	Unit
climatology_time	Climatology time	day
climatology_time_bounds	Climatology time bounds (days since 1988-01-01 00:00:00)	day
latitude	Latitude	degrees north
latitude_bounds	Latitude bounds	degrees north
longitude	Longitude	degrees east
longitude_bounds	Longitude bounds	degrees east

precipitable_water_climatology	Climatology of monthly average precipitable water over ice-free oceans	kg m ⁻²
--------------------------------	--	--------------------

Algorithm

The Special Sensor Microwave/Imager (SSM/I) and Special Sensor Microwave Imager Sounder (SSMIS) data are produced as part of NASA's MEaSUREs Program. Remote Sensing Systems generates SSM/I and SSMIS data products using a unified, physically based algorithm to simultaneously retrieve ocean wind speed (at 10 meters), atmospheric water vapor, cloud liquid water, and rain rate. This algorithm is a product of 20 years of refinements, improvements, and verifications. While the algorithms have evolved over time, a substantial background to the radiative transfer function used to derive the geophysical parameters is described in the following papers:

- [A well-calibrated ocean algorithm for SSM/I](#)
- [SSM/I Rain Retrievals within a Unified All-Weather Ocean Algorithm:](#)
- [AMSR Ocean Algorithm, Version 2](#)
- [Supplement 1 Algorithm Theoretical Basis Document for AMSR-E Ocean Algorithms](#)
- [SSM/I Version-7 Calibration Report](#)

References

Wentz F. J. 1997, "A well-calibrated ocean algorithm for SSM/I", J. Geophys. Res., Vol. 102, No. C4, pg. 8703-8718.

Wentz Frank J. 2013, "SSM/I Version-7 Calibration Report", Remote Sensing Systems, Santa Rosa, CA.

Wentz, Frank J. and Roy W. Spencer, May 1, 1998, "SSM/I Rain Retrievals within a Unified All-Weather Ocean Algorithm", Journal of the Atmospheric Sciences, Vol. 55, pg. 1613-1627.

Wentz, Frank J. and Thomas Meissner, 2000, "AMSR Ocean Algorithm, Version 2", report number 121599A-1, Remote Sensing Systems, Santa Rosa, CA, 66 pp.

Wentz, Frank J. and Thomas Meissner, 2007, "Supplement 1 Algorithm Theoretical Basis Document for AMSR-E Ocean Algorithms", Remote Sensing Systems, Santa Rosa, CA.

Description of Remote Sensing Systems Version-7 Geophysical Retrievals by Hilburn et al., 2010.

Contact Information

To order these data or for further information, please contact:

Global Hydrology Resource Center

User Services

320 Sparkman Drive

Huntsville, AL 35805

Phone: 256-961-7932

E-mail: support-ghrc@earthdata.nasa.gov

Web: <https://ghrc.nsstc.nasa.gov/>